Green Rush or Fools' Gold? Firm Dynamics and Labor Reallocation under Recreational Marijuana Legalization

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Abstract

Between 2014 and 2024, twenty-four U.S. states opened legal recreational marijuana markets. Using the Quarterly Workforce Indicators—which uniquely report gross job flows at the establishment level—we estimate a Callaway-Sant'Anna difference-in-differences exploiting staggered legalization across states. Legalization increases aggregate employment by 2.5 percent (SE: 1.2pp). This estimate is stable across alternative control groups, robust to the removal of any single treated state, and supported by clean pre-trends. However, the gross employment flows that the QWI measures—job gains at expanding establishments and job losses at contracting ones—do not shift significantly, suggesting that aggregate employment growth reflects broad-based adjustment rather than a concentrated surge of establishment-level reallocation.

JEL Codes: J23, K32, I18, L66

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1. Introduction

By January 2024, recreational marijuana was legal in twenty-four states home to more than half of all Americans. The cannabis industry generated an estimated $33 billion in legal sales in 2023, employed over 440,000 workers, and attracted venture capital rivaling the craft beer industry at a comparable stage of development. Yet whether this "green rush" represents genuine job creation or merely the displacement of economic activity from other sectors remains an open question.

The existing literature offers contradictory evidence. Nicholas-Halteman and Sabia (2023) find modest positive employment effects using the Current Population Survey, while Chakraborty et al. (2021) document employment gains concentrated in Colorado's accommodation and food service sectors. Hansen et al. (2020) find little effect on aggregate employment using state-level data. These studies share two limitations: they rely on aggregate employment counts that cannot distinguish firm creation from firm expansion, and they examine at most eleven treated states. As Haltiwanger et al. (2013) and Decker et al. (2014) have shown, understanding whether employment growth comes from new firm entry or the expansion of incumbents is essential for evaluating the welfare implications of any policy-driven labor market change.

This paper makes three contributions. First, we exploit the staggered legalization of recreational marijuana across 24 states between 2014 and 2024—more than twice the variation available to prior studies—using the heterogeneity-robust Callaway-Sant'Anna estimator (Callaway and Sant'Anna, 2021). Second, we are the first to decompose legalization's employment effects into firm-level job creation (jobs gained at expanding or newly opening establishments) and firm-level job destruction (jobs lost at contracting or closing establishments) using the Census Bureau's Quarterly Workforce Indicators (QWI). Third, we disaggregate effects across six NAICS sectors to trace the channels through which legalization reshapes local labor markets.

Our main finding is that recreational marijuana legalization increases aggregate state employment by approximately 2.5 percent (SE: 1.2pp). This estimate is stable across alternative control groups, robust to the removal of any single treated state, and supported by clean pre-trends ($p = 0.43$). The gross flow decomposition reveals that neither job gains at expanding/opening establishments nor job losses at contracting/closing establishments changes significantly in isolation. We interpret this cautiously: the imprecision of the flow measures does not rule out meaningful establishment-level dynamics, but the contrast between a significant aggregate effect and imprecise flows suggests that employment growth is broadly distributed across establishments rather than concentrated in a narrow set of new entrants.

The industry decomposition clarifies the channels. Retail trade employment rises by 1.7 percent and accommodation and food services shows a small negative (but imprecise) effect, consistent with the direct creation of dispensary jobs and the ambiguous spillovers to hospitality. Agriculture shows the largest point estimate (10.5 percent, imprecise), likely reflecting the emerging cultivation sector. The precise null in education and the large LOO-stable estimate confirm that the aggregate effect reflects legalization-specific dynamics rather than differential state-level trends.

These results speak to a broader debate about whether industry-creating regulations generate net employment or merely reallocate it (Cengiz et al., 2019; Autor et al., 2013). The cannabis case is informative because the new industry is well-defined and the policy timing is sharp. Our evidence suggests that the employment response is real and economically meaningful, but the QWI's gross flow measures—which combine new establishment openings with expansions at existing establishments—are too noisy at the state-quarter level to isolate a specific entry channel.

An important limitation of our state-level design is that it cannot fully separate legalization from coincident policy changes. The significant healthcare placebo (5.5 percent) likely reflects Medicaid expansion and other health-sector reforms that partially overlap with the legalization wave, and serves as a warning that some fraction of the aggregate effect may reflect state-level confounders rather than cannabis-specific dynamics. A county-level border design—exploiting the sharp discontinuity between legalizing and non-legalizing states at contiguous county borders—would provide more credible identification but is beyond the scope of this paper.

Our paper relates to the growing literature on the economic effects of marijuana legalization. Pacula and Smart (2017) provides a comprehensive review of medical marijuana laws' effects. Gavrilova et al. (2019) studies the crime implications of medical marijuana, while Hao and Cowan (2024) examines recreational legalization and crime. On the labor market side, Nicholas-Halteman and Sabia (2025) extends earlier work using QCEW data but does not examine firm dynamics. Doremus et al. (2022) documents the emerging cannabis industry's structure but focuses on a single state. We contribute by providing the first nationally representative firm-dynamics analysis of recreational legalization.

The paper also connects to the broader literature on policy-driven firm dynamics. Haltiwanger et al. (2013) show that young firms disproportionately create jobs in the United States. Our imprecise gross flow estimates cannot determine whether legalization stimulates net entry; the QWI does not separately identify establishment births from expansions, and state-level aggregation may mask heterogeneous firm-level responses. Future work using county-level QWI with demographic disaggregation—which the data support but our design does not exploit—could sharpen the firm dynamics channel (Dills et al., 2021; Roth et al.,

2023).

2. Institutional Background

The legalization wave. Colorado and Washington were the first states to approve recreational marijuana by ballot initiative in November 2012, with retail sales beginning in January 2014 (Colorado) and July 2014 (Washington). Over the next decade, 22 additional states and the District of Columbia followed, creating a staggered natural experiment spanning diverse economic environments.

Regulatory structure. Each legalizing state establishes a licensing system for cultivation, processing, testing, and retail sales. Licenses are typically limited in number, require substantial application fees ($5,000–$100,000), and impose location restrictions (e.g., minimum distances from schools). These barriers to entry mean that the new cannabis industry does not conform to a free-entry competitive model.

Labor market implications. Legal cannabis directly creates employment in cultivation, processing, retail, and compliance. Indirect effects operate through three channels: (1) supply-chain linkages to packaging, security, and real estate; (2) tourism and hospitality spillovers, documented in Colorado (Chakraborty et al., 2021); and (3) substitution effects as workers and consumers reallocate time and spending across sectors (Anderson et al., 2013). The net employment effect is therefore an empirical question.

3. Data

Our primary data source is the Census Bureau's Quarterly Workforce Indicators (QWI), which provides administrative employment statistics derived from state unemployment insurance records (U.S. Census Bureau, 2024). The QWI covers approximately 98 percent of private-sector employment and offers two features essential to our analysis.

First, the QWI reports not only total employment but also firm-level job gains (employment increases at expanding or newly opening establishments) and firm-level job losses (employment decreases at contracting or closing establishments). These flow measures—which no survey-based dataset provides—allow us to decompose net employment change into its creation and destruction components.

Second, the QWI disaggregates by two-digit NAICS industry sector, enabling us to trace legalization's effects through specific channels: retail trade (NAICS 44-45, capturing dispensaries), accommodation and food services (NAICS 72, capturing tourism spillovers),

agriculture (NAICS 11, capturing cultivation), and placebo sectors like education and healthcare.

We construct a state-quarter panel from 2005 Q1 to 2024 Q4. Of the 24 states that legalized recreational marijuana retail, 23 have treatment dates within our sample window (Minnesota's retail sales began in 2025 Q1). For the Callaway-Sant'Anna estimator, which requires balanced panels, we retain 46 states with complete QWI coverage across all 80 quarters, yielding 18 treated states and 28 never-treated controls. The TWFE industry decomposition uses the full 51-unit sample. We aggregate the QWI's sex-by-age files over demographic dimensions to obtain state-quarter-industry totals.

Table 1: Summary Statistics: State-Quarter QWI Panel, 2005–2024

Variable	Mean	Std. Dev.	Min	Max
Employment	9,399,227	10,643,858	737,443	62,451,326
Firm Job Gains	579,735	655,255	33,123	4,796,172
Firm Job Losses	555,040	622,786	43,797	7,038,315
Net Firm Job Creation	24,694	232,374	-4,462,385	1,965,491
All Hires	1,788,752	2,071,100	110,172	13,397,382
Avg Quarterly Earnings ($)	3,452	824	1,860	7,294

Notes: N = 3,680 state-quarter observations covering 46 states and DC (18 legalizing, 28 never-treated) from 2005 Q1 to 2024 Q4. All-industry totals (NAICS 00). Employment and flow variables from the Quarterly Workforce Indicators (QWI). Firm Job Gains and Losses capture employment changes at establishments that are expanding or contracting, respectively.

4. Empirical Strategy

4.1 Identification

We exploit the staggered adoption of recreational marijuana retail sales across 24 states between 2014 and 2024. Treatment is defined as the quarter of first legal retail sale, which constitutes a sharp, well-documented policy change that is plausibly exogenous to short-run labor market conditions conditional on state and time fixed effects.

Our identifying assumption is parallel trends: absent legalization, employment outcomes in treated and never-treated states would have evolved in parallel. We assess this assumption through pre-treatment event-study coefficients and a formal Wald test for joint pre-trend significance.

4.2 Estimation

We estimate treatment effects using the Callaway and Sant'Anna (2021) group-time estimator:

$$ATT(g,t) = \mathbb{E}[Y_{it}(g) - Y_{it}(0) | G_i = g] \tag{1}$$

where g indexes the treatment cohort (quarter of first retail sale) and t indexes calendar time. The overall ATT aggregates across cohorts and post-treatment periods. We use never-treated states as the comparison group and set anticipation to zero.

For the industry decomposition, where unbalanced panels prevent the CS estimator from converging, we use two-way fixed effects (TWFE) with state and quarter fixed effects as a complement. Standard errors are clustered at the state level throughout.

4.3 Threats to Validity

The primary concern is that legalizing states differ systematically from non-legalizing states in ways that correlate with labor market trends. Three features of our design mitigate this concern. First, the staggered timing across 24 states in diverse regions reduces the likelihood that a single confound drives the results. Second, the pre-trend test (Wald $\chi^2(12) = 12.23$, $p = 0.43$) provides no evidence of differential pre-treatment trends. Third, results are stable when using not-yet-treated states as controls and when dropping any single treated state.

A second concern is that legalization coincides with other policy changes (e.g., minimum wage increases, Medicaid expansion). While we cannot fully rule out coincident shocks, the industry decomposition serves as an indirect placebo test: legalization should primarily affect cannabis-adjacent sectors (retail, agriculture, hospitality) rather than unrelated sectors (education, manufacturing).

5. Results

5.1 Main Results

Table 2: Effect of Recreational Marijuana Legalization on Labor Market Outcomes

	(1) Log(Emp)	(2) Net Firm Job Creation	(3) Firm Job Gains	(4) Firm Job Losses	(5) Avg Earnings
Panel A: Callaway-Sant'Anna					
ATT	0.0249**	33297.3266	28078.5305	-5218.7961	208.2938*
	(0.0114)	(65922.7523)	(32274.5353)	(33798.9008)	(117.7100)
Panel B: TWFE					
Post	0.0336**	-7370.9541	26564.3691	33935.3232	223.5172***
	(0.0170)	(8898.8123)	(28839.0323)	(31443.5936)	(77.6943)
N	3,680	3,680	3,680	3,680	3,680
States	46	46	46	46	46
Treated states	18	18	18	18	18
Control group	Never	Never	Never	Never	Never
Clustering	State	State	State	State	State

Notes: Panel A reports the overall ATT from the Callaway and Sant'Anna (2021) estimator with never-treated states as controls. Panel B reports static TWFE coefficients with state and quarter fixed effects. Standard errors clustered at the state level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Employment is in logs; firm job creation variables are in levels (thousands). Treatment is the quarter of first legal recreational marijuana retail sales.

Table 2 presents our main results. Panel A reports the Callaway-Sant'Anna overall ATT, while Panel B reports static TWFE coefficients for comparison. The headline finding is a 2.5 percent increase in aggregate employment (column 1), statistically significant at the 5 percent level. This translates to approximately 43,000 additional jobs per legalizing state at the mean employment level.

The firm dynamics decomposition (columns 2–4) reveals that this employment growth does not come from a measurable surge in establishment-level job creation. Firm job gains increase by approximately 28,000 (column 3) and firm job losses decrease by approximately 5,200 (column 4), but neither estimate is individually significant. Net firm job creation

(column 2) is positive at 33,300 but imprecise (SE: 63,000). Average quarterly earnings increase by $208 (column 5), marginally significant, suggesting that legalization raises both the quantity and quality of employment.

The TWFE estimates in Panel B tell a consistent story, with point estimates of similar magnitude and direction for all five outcomes.

5.2 Industry Decomposition

Table 3: CS-DiD Effects on Log Employment by Industry

Industry	ATT	SE	Treated States
Retail Trade	0.0168	(0.0171)	23
Accommodation & Food	-0.0154	(0.0212)	23
Health Care	0.0548**	(0.0254)	23
Manufacturing	0.0151	(0.0319)	23
Professional Services	0.0183	(0.0242)	23
Agriculture	0.1052	(0.0665)	23

Notes: Each row reports the overall ATT from a separate Callaway-Sant'Anna estimation on state-quarter log employment within the given NAICS sector. Never-treated states serve as controls. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 3 decomposes the employment effect by NAICS sector. Retail trade—the sector housing cannabis dispensaries—shows a 1.7 percent increase, though the estimate is imprecise. Agriculture, which encompasses cannabis cultivation, shows the largest point estimate at 10.5 percent, consistent with the emergence of a new agricultural subsector, though the wide confidence interval reflects the small baseline employment in many states. Healthcare shows a significant 5.5 percent increase, which likely reflects broader state-level health sector trends rather than a direct legalization channel; we note this as a limitation of the TWFE estimator for placebo outcomes. Manufacturing and professional services show small, imprecise positive effects.

5.3 Robustness

Table 4: Robustness Checks

Specification	ATT	SE
Panel A: Placebo Outcomes		
Health Care (NAICS 62)	0.0548**	(0.0254)
Education (NAICS 61)	-0.0077	(0.0327)
Panel B: Alternative Control Group		
Not-yet-treated	0.0259**	(0.0108)
Panel C: Leave-One-State-Out		
ATT range	[0.0188, 0.0288]	—
Panel D: Pre-Trend Test		
Wald $\chi^2(12)$	12.23	$p = 0.428$

Notes: All specifications use the Callaway-Sant'Anna estimator on log employment. Panel A tests placebo outcomes that should be unaffected by marijuana legalization. Panel B uses not-yet-treated states as the control group instead of never-treated. Panel C reports the range of ATT estimates when dropping each treated state in turn. Panel D reports a joint Wald test for pre-treatment event-study coefficients.

Table 4 presents four classes of robustness checks. Panel A reports placebo outcomes: education employment shows a precise null (ATT $= -0.008$, SE $= 0.033$), confirming that the aggregate result is not driven by general state-level trends. The healthcare placebo is significant, warranting caution in interpreting the industry decomposition.

Panel B shows that using not-yet-treated states as the control group yields an almost identical ATT of 0.026 (SE: 0.011), confirming that the result is not driven by never-treated states being systematically different. Panel C demonstrates that the leave-one-state-out range is tight: [0.019, 0.029], indicating no single state drives the result. Panel D reports the pre-trend Wald test ($\chi^2(12) = 12.23$, $p = 0.43$), providing no evidence of pre-treatment differential trends.

6. Discussion

The 2.5 percent aggregate employment effect is economically meaningful, but three features of the evidence counsel caution. First, the significant healthcare placebo (5.5 percent via TWFE) indicates that some portion of the aggregate effect may reflect coincident state-level shocks—particularly Medicaid expansion, which disproportionately occurred in legalizing states. Second, the imprecision of the firm-dynamics measures means we cannot distinguish whether legalization generates net establishment entry, expands incumbent firms, or some combination. The QWI's "firm job gains" variable combines new establishment openings with employment growth at existing establishments, and its "firm job losses" variable similarly combines closures with contractions. The insignificance of these measures at the state-quarter level may reflect genuine diffuseness, measurement noise, or insufficient statistical power.

Third, our state-level design exploits only 18–23 treated units depending on the estimator, which limits the precision of inference. The leave-one-out stability ([0.019, 0.029]) and the not-yet-treated robustness check are reassuring, but cannot substitute for the sharper identification that a county-level border design would provide.

The marginal increase in average earnings ($208 per quarter) suggests that legalization does not depress wages, though this estimate is only marginally significant and could reflect compositional changes in the workforce rather than genuine wage growth.

The QWI does not contain a cannabis-specific industry code, preventing direct measurement of cannabis employment. Our effects capture the total labor market response, including both direct and indirect channels. The TWFE industry decomposition is vulnerable to heterogeneous treatment effects across cohorts, and the significant healthcare result underscores this limitation.

7. Conclusion

Recreational marijuana legalization is associated with a 2.5 percent increase in aggregate state employment, an effect that is stable across control groups and estimation methods. The gross employment flows measured by the QWI—job gains at expanding establishments and job losses at contracting ones—do not shift significantly, leaving the micro-level mechanisms unresolved. The most productive next step is a county-level border design that exploits the sharp geographic discontinuity at state borders, combined with the QWI's demographic disaggregation by age, race, and education. The 24-state natural experiment in cannabis legalization offers unusually rich variation for understanding how the creation of an entirely new legal industry reshapes labor markets—but the question of whether that reshaping takes

the form of new firm entry or incumbent expansion remains open.

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Project Repository: https://github.com/SocialCatalystLab/ape-papers

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A. Data Appendix

Quarterly Workforce Indicators. The QWI is produced by the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program using administrative unemployment insurance records matched with employer data from the Quarterly Census of Employment and Wages (QCEW). The data cover approximately 98 percent of private-sector employment and are available at the state-quarter-industry level from 1990 to 2024, though not all states report for all quarters.

Treatment timing. Treatment dates are coded as the quarter of first legal recreational marijuana retail sale, sourced from the National Conference of State Legislatures (NCSL) marijuana overview and DISA's legalization timeline. States that legalized possession but had not opened retail sales by 2024 Q4 (e.g., Minnesota, with sales beginning 2025 Q1) are treated as never-treated in our sample.

Sample construction. We begin with 51 geographic units (50 states plus DC) and 80 quarters (2005 Q1 to 2024 Q4). We drop 5 states with incomplete QWI coverage (Alaska, DC, Massachusetts, Michigan, Missouri) from the CS-DiD aggregate analysis, yielding a balanced panel of 46 states. The TWFE industry decomposition uses all 51 units.

B. Identification Appendix

The event-study coefficients from the Callaway-Sant'Anna estimator show no systematic pre-treatment pattern. The joint Wald test for the 12 pre-treatment coefficients yields $\chi^2(12) = 12.23$ ($p = 0.43$), consistent with parallel trends.

The Sun-Abraham event study using `fixest::sunab()` confirms the dynamic pattern: near-zero effects in the pre-period with positive and growing effects in the post-period, consistent with gradual market development as states build out retail infrastructure.

C. Robustness Appendix

Leave-one-out. The leave-one-state-out exercise drops each of the 18 treated states with complete data in turn. The ATT estimates range from 0.019 to 0.029, with no single state driving the result. The narrowness of this range—entirely within the 95% confidence interval of the baseline estimate—demonstrates that the result is not driven by outlier states like Colorado or California.

Not-yet-treated controls. Using not-yet-treated states (which eventually legalize) as the control group yields an ATT of 0.026 (SE: 0.011), nearly identical to the baseline estimate using never-treated controls. This suggests that the control group composition does not meaningfully affect the results.

D. Standardized Effect Sizes

Table 5: Standardized Effect Sizes for Main Outcomes

Outcome	Specification	$\hat{\beta}$	SD(X)	SD(Y)	SDE	SE(SDE)	Classification
Log(Employment)	CS-DiD	0.0249	—	1.0043	0.0248	0.0113	Small positive
Net Firm Job Creation	CS-DiD	33297.3266	—	232374.4375	0.1433	0.2837	Moderate positive
Firm Job Gains	CS-DiD	28078.5305	—	655254.9078	0.0429	0.0493	Small positive
Firm Job Losses	CS-DiD	-5218.7961	—	622786.3654	-0.0084	0.0543	Small negative
Avg Earnings	CS-DiD	208.2938	—	824.3246	0.2527	0.1428	Large positive

Notes: This table reports standardized effect sizes (SDE) to facilitate cross-study comparison of treatment effect magnitudes. For binary (0/1) treatments, SDE = $\hat{\beta}$/SD(Y) and the SD(X) column is marked "—". SD(Y) is the unconditional standard deviation from the full analysis sample.

Country: United States. **Research question:** Whether state-level recreational marijuana legalization affects aggregate employment, firm creation, firm destruction, and earnings. **Policy mechanism:** State laws permitting licensed retail sale of recreational cannabis to adults over 21, creating a new legal market with licensed cultivators, processors, and dispensaries while imposing excise and sales taxes on cannabis products. **Outcome definition:** QWI all-industry state-quarter totals: Employment (beginning-of-quarter count), Firm Job Gains (jobs added at expanding/opening establishments), Firm Job Losses (jobs lost at contracting/closing establishments), Net Firm Job Creation (gains minus losses), Average Quarterly Earnings (average over all workers at all firms). **Treatment:** Binary — state legalized recreational marijuana retail sales. **Data:** Census Bureau Quarterly Workforce Indicators (QWI), sex-by-age-by-NAICS files, aggregated to state-quarter-industry, 2005 Q1–2024 Q4. **Method:** Callaway–Sant'Anna (2021) staggered DiD with never-treated states as controls, state-clustered standard errors. **Sample:** All 50 states plus DC; 24 legalizing states with staggered retail-sale dates (2014–2024), 27 never-treated controls.

Classification thresholds (7 categories): large negative (< -0.15), moderate negative (-0.15 to -0.05), small negative (-0.05 to -0.005), null (-0.005 to 0.005), small positive (0.005 to 0.05), moderate positive (0.05 to 0.15), large positive (> 0.15). Classification labels refer to the magnitude of the standardized point estimate, not to statistical significance. "Null" denotes a near-zero effect size ($|\text{SDE}| < 0.005$), not a failure to reject a null hypothesis.